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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

EEL4106 – HIGH VOLTAGE ENGINEERING
(LE)

23 OCTOBER 2017
2.30 P.M. – 4:30 P.M.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 3 pages including the cover page with 4 Questions only.
2. Answer **ALL** questions. The distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

Question 1

(a) List down THREE main types of voltages being generated at high levels for testing purposes. For each type, mention ONE technology which can be employed to generate it. [6 Marks]

(b) Design an electrostatic generator which can generate $900\mu\text{A}$. You may assume the belt's velocity to be any value within the range of $15\text{-}30\text{ms}^{-1}$. The generator is to be enclosed in an earthed tank filled with Sulphur Hexafluoride (SF_6) which has breakdown strength of 25MVm^{-1} and relative permittivity of 3.8. [5 Marks]

(c) In a High Voltage lab, you were tasked to design an impulse generator by using any of the available components of 1nF , 50nF , 100nF , $30\mu\text{F}$, 360Ω , 500Ω and $1\text{k}\Omega$. Draw the circuit of your design. Evaluate the expected output of your generator with charging voltage of 200kV . [14 Marks]

Question 2

(a) Identify and describe THREE types of standard high voltage tests. [6 Marks]

(b) List down FOUR types of high voltage test on cables. [4 Marks]

(c) You have applied 20 shots of Up and Down standard lightning impulse test to an insulation of a high voltage cable. Complete Table Q2(c) and calculate the 50% breakdown voltage and the standard deviation. [15 Marks]

Table Q2(c)

Voltage (kV)	Test Result																			
50						X														
49																			X	X
48																				
47		X									O						O			
46	O		O																	
45																O				

Continued.....

Question 3

(a) Compare the rate at which solid, liquid and gas recovers its respective strength after suffering from electrical breakdown. [3 Marks]

(b) Table Q3 shows the experimental measurements obtained while studying the Townsend phenomenon in a gas under a uniform electric field. Note that d is the gap distance while I is the measured current at each corresponding gap distance. Compute the values of the Townsend's first and second ionization coefficient. You are required to construct a graph by making use of the data in Table Q3 in order for you to perform the required computation.

Table Q3

d (mm)	1	2	3	4	5	6	8	10	12	14	16
I (pA)	17	20	25	31	38	43	75	100	148	265	460

[12 Marks]

(c) With the help of a graph, illustrate the mechanisms of failure and variation of breakdown strength in solids with time of stressing. Then, briefly explain each mechanism. [10 Marks]

Question 4

(a) Define an insulation coordination. [3 Marks]

(b) List down FOUR types of insulation. Then, explain each type. [12 Marks]

(c) Insulation failure may occur due to power frequency voltages or impulse voltages. List down two possible reasons due to each of the aforementioned type of voltages. [4 Marks]

(d) Outline THREE requirements to be fulfilled to ensure optimum insulation coordination. [6 Marks]

End of the Paper.